Backward Integration of a SL9 Type Comet

K. K. Yau, D. K. Yeomans, P. R. Weissman and P. W. Chodas

(JPL/Caltech)

The appearance of cornet Shoemaker-Levy 9 (SL9) has focused interest on Jupiter's capture mechanism of comets. The orbit of SL9 presents us with a case study on the capture process. An attempt to understand this type of orbit *is* made by following the orbit of SL9 backward in time via a numerical integration. The initial conditions were established from observations through January 1994 using the JPL CMOD orbit determination program developed by P. Chodas using a weighted least squares technique (Yeomans *et* al., *Astron. J.* **94**, 189, 1987). Only nine of the 22 fragments of SL9 have enough observations for their orbit to be well determined. For this numerical experiment, we selected an initial orbit for the brightest fragment (Q) for our long-term integration and we assumed the July 1992 disruption had no effect on the fragment's dynamic history. Initial conditions were varied to give a number of possible cases. The present integrator uses a variable step and order Adams method (Krogh, *Lecture Notes in Mathematics* 362, **22, 1972).** The equations of motion include perturbations due to all nine planets, and a relativistic correction term so as to be compatible with the planetary ephemeris. Due to the dose proximity to Jupiter, perturbations introduced by Jupiter's oblateness (Anderson, in *Jupiter, ed.* T. Gehrels, pp. 113–121, 1976) and the four Galilean satellites (Lieske, *Astron. Astrophys.* **56, 333,** 1977) are taken into account. For the accelerations introduced by Jupiter's oblateness, only the zonal harmonic terms with coefficients J_2 and J_4 have been considered. Based upon our preliminary analysis, a number of possible pre-disruption heliocentric orbits are presented.